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Synthesis and Photocatalytic activities of TiO_2-Loaded Ordered Mesoporous Carbon CMK-3

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Nanosized Titanium oxide (TiO_2) of anantase phase has shown high photocatalytic performance owing to its large surface area. In this report, TiO_2-loaded ordered mesoporous carbon materials were synthesized using CMK-3 (Carbon Mesostructured by KAIST) as a supporting material. After preparing the CMK-3 via template synthesis methode with SBA-15, TiO_2 precursors, the mixture of titanium isopropoxide and isopropyl alcohol, were introduced into the CMK-3 pores. Then, the mixture was calcined at temperatures of 500, 700, and 900 ℃ under nitrogen atmosphere. Such formed TiO_2/CMK-3 photocatalysts were characterized by XRD, N_2 physisorption, TEM, and XPS. It was found that all synthesized materials had 2-D hexagonal structures with only anatase TiO_2. In TiO_2/CMK-3 calcined above 700 ℃, TiO_2 existed on the external surface of CMK-3. However, TiO_2 remained inside the CMK-3 structure when the TiO_2/CMK-3 was calcined at 500 ℃. The activities of these photocatalysts were investigated by measuring the photodegradation of aqueous Rhodamine 6G (R6G) under UV-light irradiation. TiO_2/CMK-3 with externally deposited TiO_2 showed superior photocatalytic activities than commercial P25. TiO_2/CMK-3 calcined at 700 ℃ completely degraded the R6G in two hours whereas degradation process with P25 was not completed within four hours. Such a superior catalytic activity seems to originate from the synergic combination of large absorption capacity of TiO_2/CMK-3 photocatalyst with anatase phase of TiO_2.